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SOURCE Stanki 1 instrument, No 9, 1950.POLISHING METALS BY LIQUID ABRASIVE SPRAYING IN SOVIET INDUSTRY

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Liquid abrasive processing of metal in many branches of industry is beginning to assume more and more importance as an effective method for polishing surfaces of machinery parts.

When polishing complex-shaped parts which are not always easily accessible to a cutting tool, the expenditure for special machine tools and the input of working time reach large proportions.

The effort to develop a cutting edge independent of a tool holder, slide, or machine tool brought into practice the use of sprayed abrasives or metals. Among the most effective methods of utilizing the percussive effect of grains is liquid abrasive blasting.

Under a liquid abrasive jet, rough surfaces on metal are smoothed and brought to a high degree of finish.

In contrast to cutting and grinding processes which leave graduation lines and microcracks on the machined surface, the suggested method removes rough ridges remaining after preliminary operations. As a result of this and the cold-hardening effect it has on the surface being worked, the physical properties of the surface layer and the part's fatigue resistance are improved. The temperature of the work piece remains practically constant.

The liquid abrasive process makes possible extensive varying of types of abrasives used, their sizes, the quantitative proportion of abrasives and emulsion, air pressure, distance between the nozzle and the surface being worked, and the angle of slant of the jet and spraying head.

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Suitable chemicals are added to the emulsion to prevent corrosion of steel and cast-iron parts being worked by this method. The cutting liquid penetrates a certain depth into the surface layer of the metal and transmits a high and lasting corrosion-resistant property.

All types of metal, regardless of hardness, the most diversified-shaped parts, and almost any sizes of parts can be worked by liquid abrasive blasting. Ovalness, conicity, and other irregular properties are maintained because the metal is removed evenly.

With a very fine abrasive and suitable emulsion compound, the surface can be finished to eight- or ninth-class precision. To achieve such a finish, the process is carried out step by step from coarse to fine abrasives. The number of passes and the type of abrasive grains depend on the roughness of the original surface.

Liquid abrasive blasting can be used successfully in finishing connecting rods, compressor vanes, bearing races, connecting rod bolts, gear teeth, turbine blades, holes in machine-tool head and tail stocks, instrument parts, cutting tools, dies, permanent molds for casting, and draw plates.

Liquid abrasive blasting can also be used when preparing surfaces for metal plating, after welding and soldering, for trimming seams, and for removing clogging. For example, spring steel can be cleaned effectively without danger of the hydrogen brittleness which results from acid corrosion. Projecting edges, skin, and roughness on inside hollows of complex forgings and castings can be removed effectively by liquid polishing with a large saving in manpower and production cost.

After liquid abrasive processing, the surface does not reflect light. This makes the method suitable for use in manufacturing verniers, instrument scales, and parts for optical instruments.

The process does not require complicated equipment and can be successfully carried out directly on conveyer lines, or in small production and repair shops. The cutting liquid is changed every 40-60 hours of continuous operation. Equipment for recovery of abrasives is not required. The cutting liquid consumed is replaced by the addition of abrasive and emulsion every 8-10 hours.

Various types of liquid abrasive units are now in use. They can be reduced to three basic types, differing only in the method of feeding the cutting liquid. The liquid may be fed to the spraying jet by: (1) gravity flow, (2) pump, or (3) compressed air.

In the first type, units are made of sheet steel in the form of a chamber having a grated floor. The operator works inside the chamber. The used cutting liquid flows through the floor grate and gathers in an air-tight tank. Here the emulsion mixes with compressed air and is fed through a pipe into the service tank. From this tank the cutting liquid flows by gravity to the jet, where it is sprayed on the work by compressed air at a pressure of 5-6 atmospheres. The chamber has an exhaust-ventilating system.

The second type of unit consists of a cabinet in which the part is blasted, a bunker for the abrasive and liquid, a circulating pump, a spraying jet, and exhaust system, and a source for compressed air. The cabinet has a window through which the process can be watched, and doors for loading. The operator is outside the cabinet and can reach the work by using special long-sleeve gloves.

The appended sketch shows the third type of unit.

This unit consists of a chamber (8) for blasting the part and a tank (1) containing the abrasive and liquid mixture. The capacity of the tank is 70-120 liters. The chamber can be equipped with a rotary table, conveyer, or special clamping device.

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The liquid is fed from the tank (1) through a hose to the jet (12) by means of compressed air. The liquid is sprayed and ejected by compressed air which passes through a hose (15) to the jet (12).

During operation, the liquid and abrasive combine in the conical part (3) of the chamber (8). After all of the available liquid in the tank (1) is spent, the inflow of compressed air into the tank is stopped by means of a three-way spigot and the tank is again opened to the atmosphere. Valve (2) drops down under the effect of the liquid column and its own weight, and the liquid returns to tank (1).

For securing and removing the work piece, the chamber is equipped with a door (6) and trap doors (5). The work is watched through a window (7). The chamber is lighted by electric bulbs enclosed by reflector (11). The cylindrical part of the chamber (8) and the conical part (3) are separated by a metal net which protects the tank from falling metal parts or other foreign matter. The chamber is equipped with a special plate (14) for securing clamps (13) and other fixtures. The inside of the window (7) is washed by water from a perforated pipe. The conical part (3) of the chamber is equipped with a device for draining the surplus water into a canal. There is a hole cut in the roof (9) of the chamber for connecting the unit with the exhaust ventilating system (10).

A mixer (19) in the tank keeps the abrasive suspended in the liquid. The mixer is rotated by an electric motor (18) with a drive belt (17) and cylindrical gears (16); the latter are housed to guard them from the abrasive and dust.

After the tank is filled with liquid and abrasive in proper proportions, valve (2) is raised and pressed to the valve seat by means of a hand lever (4) and rope, thus making the tank air tight. The closed tank is connected to the compressed-air main and a pressure of 5-6 atmospheres is maintained. If a pressure of 10 atmospheres can be achieved the blasting process is more effective.

In small series production the work can be secured in special vises during the blasting period. The work can be set and secured in the vise at any angle in relation to the axis of the jet nozzle. The vise screws and ball bearings must be protected against abrasives by rubber collars.

Work regimes will vary depending on the purpose of the operation.

The salient features of liquid abrasive blasting are:

1. A smooth surface without any machining marks can be obtained.
2. It is possible to machine complex-shaped surfaces of any hardness, of large or small dimensions.
3. The surface can be finished to a tolerance of 0.002-0.010 millimeter contours of the work (i.e., its macrography) are not lost.
4. Microcanals on the surface are formed, permitting more even distribution and better retaining of lubricants.
5. Removal of rough ridges and the impact of abrasive grains against the metal harden the surface being worked.
6. The time required for polishing operations is cut 5-15 times, and working conditions are improved.
7. Cost of equipment is low, and operation simpler.

[Sketch follows.]

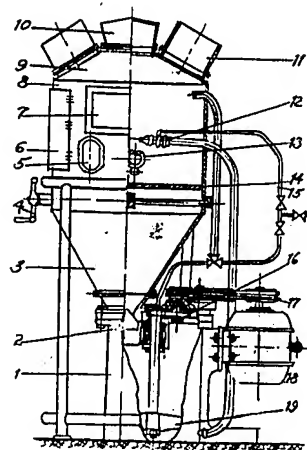
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